WSDOT CAE Review
Executive Summary

Introduction

This document presents an overview and summary of recommendations from a performance review of Computer Aided Engineering "CAE" technologies. A full report is available with more comprehensive information on staff and consultant survey results, findings, industry trends, and more detailed recommendations.

The review resulted in feedback about issues having no direct relationship to CAE technologies or area of responsibility. Recommendations are presented for these issues because some have an impact on effective use of CAE technologies.

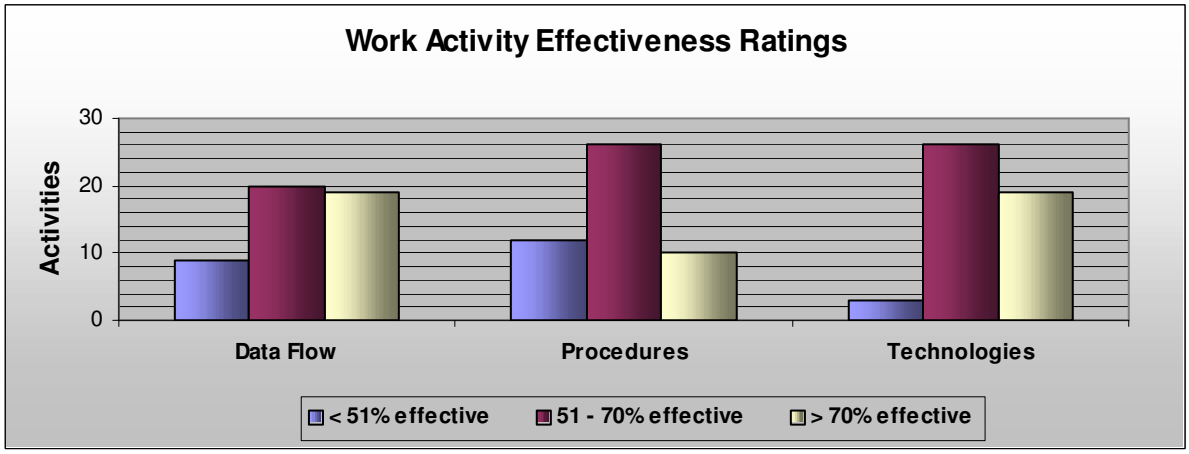
Process Overview

A technical team of HQ & Region CAE staff distributed a department-wide web survey and conducted eleven interview sessions across the state to gather input. The web survey received 396 responses, and 101 people attended interview sessions. The majority of participants have more than 10 years of experience and work in region project offices.

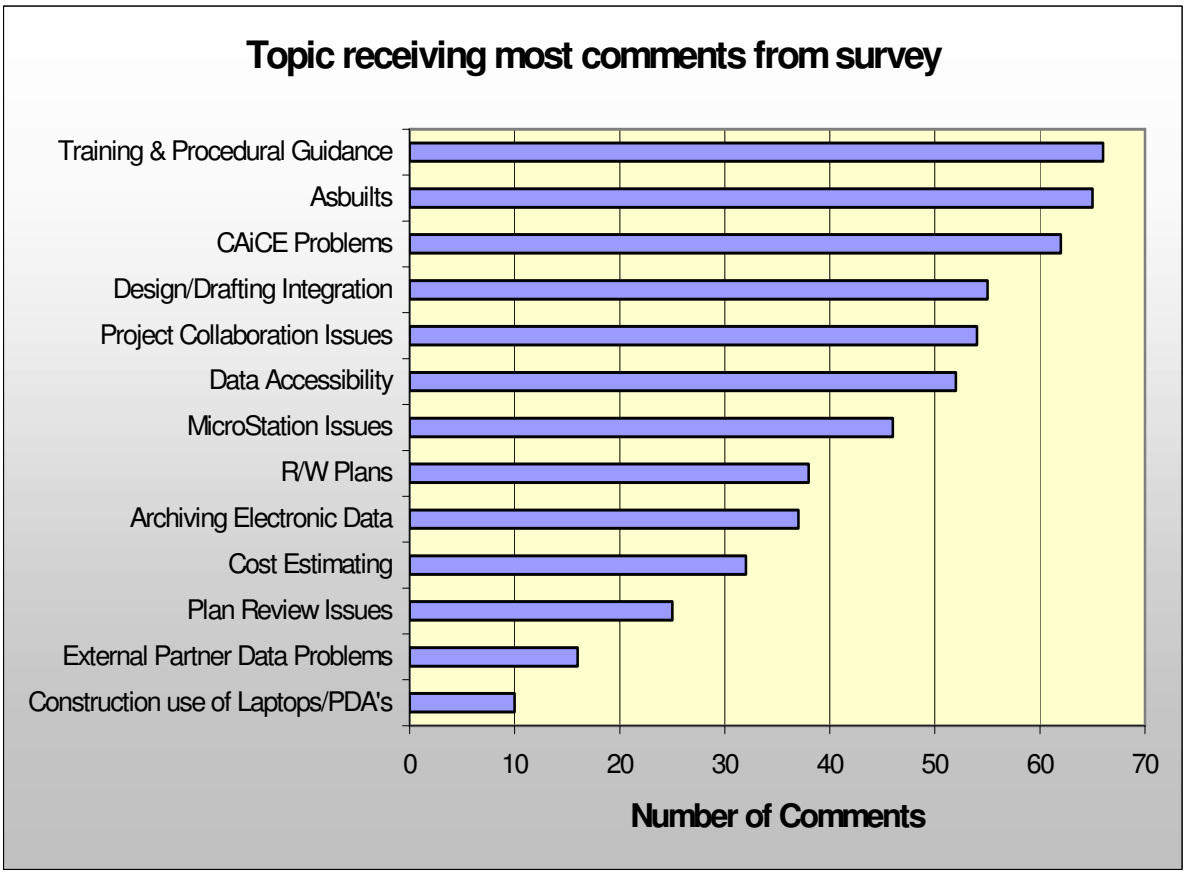
The team conducted research on industry trends. Information is presented on civil software other transportation agencies and consultants are using. Autodesk and Bentley Systems also participated in the review and each gave presentations on the future direction of civil software development within their company.

Summary of Survey Results

The following chart summarizes the results of the effectiveness ratings of 48 different project delivery work activities. Participants were asked to rate the effectiveness of data flow, procedures and technologies.



The survey also contained several open-ended questions that generated nearly 500 written comments and suggestions. The chart on the next page indicates the topics receiving the most comments



Industry Trends

Civil Software Companies

Autodesk and Bentley Systems combined own a commanding share of the civil design software solutions market. Autodesk solutions dominate the sub-division/site design arena, and have the largest overall share of the civil design market. Bentley Systems solutions are more focused on transportation corridors and are predominate with large state transportation agencies. Both companies own more than one civil solution and the long-range plan for both is to migrate from multiple civil solutions to a single solution over an undefined time span.

Consulting Firms

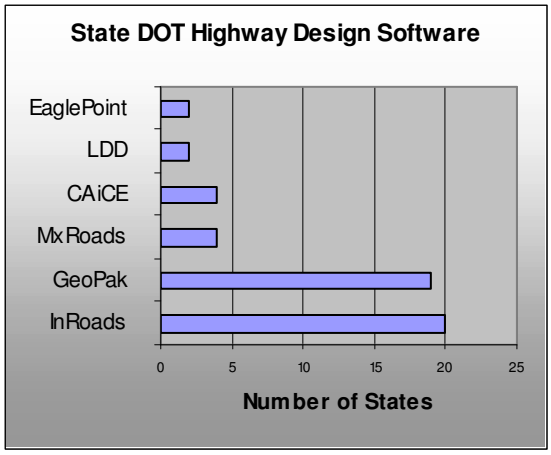
A consultant survey was distributed and provided feedback about the civil software consulting firms use and their experience working with WSDOT. Twenty-seven firms have preferred design and CAD software. Land Desktop and AutoCAD are the prevailing preference, particularly with smaller firms, with InRoads and MicroStation the second choice. Six firms indicated they have no preference and use the software specified by their clients. See the chart on following page.

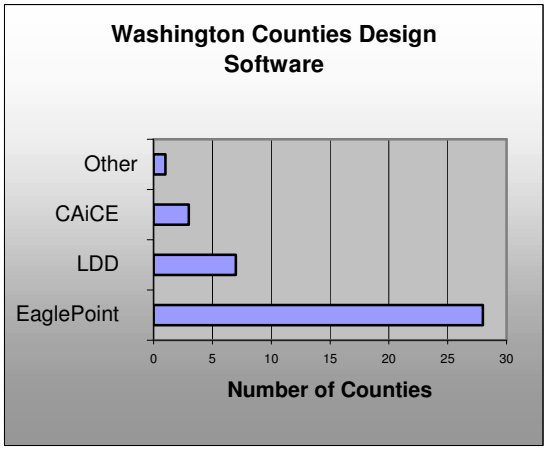
WSDOT staff report that working with consultant engineering files is a problem area, even though we require consultants to deliver in MicroStation and CAiCE formats that adhere to our data standards. Firms were asked how they meet this requirement. Approximately 50% said they

use CAiCE & MicroStation for our projects. The others either use their preferred software and convert, have not been required to deliver per the contract, or did not respond.

Civil Software Usage Charts

The charts below indicate the design software used by other State DOT's and Washington counties. CAD software is not shown on the charts, however 47 State DOT's use MicroStation CAD software, and AutoCAD is the choice with the majority of Washington counties.





The following chart displays the results of consultant input on preferred CAD and design software.

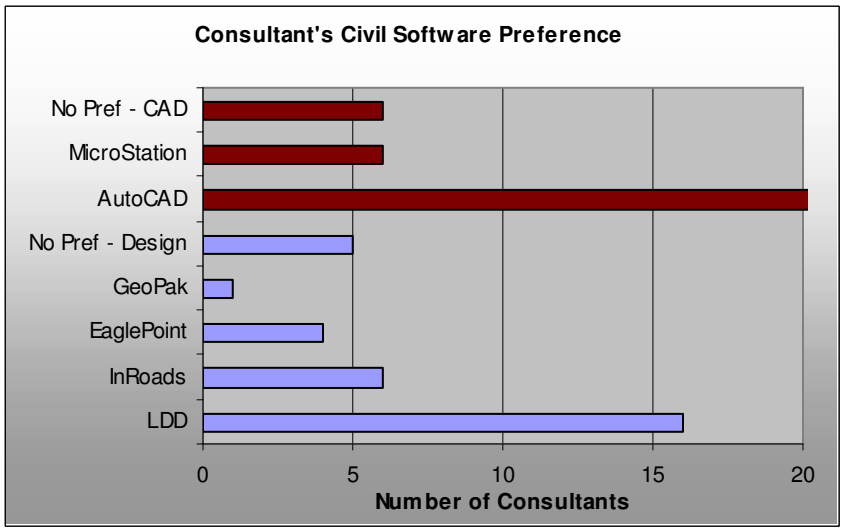


Chart Note: Autodesk owns LDD (Land Desktop), CAiCE, and AutoCAD. Bentley owns InRoads, GeoPak, MxRoads, and MicroStation.

Recommendations

Recommendations are based on the staff feedback and industry data that was collected along with the review team's professional knowledge. The recommendations have not been prioritized, nor has cost to implement been considered.

Several recommendations apply agency wide and should be implemented agency wide. These are likely to have a higher cost or operational impact and will require senior management leadership to influence change and make a decision to implement.

Other recommendations are for region, business unit, and technical group managers to evaluate and implement. Some of these do not apply in all regions, as the issue may not be prevalent due to size and operational differences.

Project Collaboration and Data Management

Recommendation 1.1
Define, institute, and enforce standard file naming conventions, documentation/file cleanup procedures, and handoff procedures for electronic project data at major milestones. Include documentation on design decisions and commitments that downstream activities need to know about.

Recommendation 1.2
Implement engineering file management technology for systematically managing engineering information to prevent data loss and improve future accessibility.

Recommendation 1.3
Encourage project design offices to involve support offices early in projects and keep them updated with changes. Encourage project support offices to provide guidance to design offices that describes their supporting role in project delivery and their information and schedule requirements.

Recommendation 1.4
Encourage project designers and surveyors to discuss project data needs early in the design process.

Recommendation 1.5
Encourage design and construction offices to discuss construction data needs that design can produce to be more useful for staking the project and administering the contract.

Recommendation 1.6
Enhance region intranet pages to provide current names of region contacts, region procedural guidance, and region specific data that are available. Enhance intranet pages of HQ business units providing project services to include current information about contacts for different services, current projects, available data, and procedural guidance

Recommendation 1.7
Implement technology for electronic distribution, review/redline, and digital signatures of plan sets.

Data Accessibility

Recommendation 2.1
Establish a long-term goal to improve data accessibility for project development by providing one stop, easy access to information. Prepare for future integration of engineering data with GIS.

Recommendation 2.2
Provide training and marketing to encourage people to use the WSDOT intranet as an information resource. Improve intranet web sites to make information easier to find.

Working with Consultants

Recommendation 3.1
Hold consultants accountable for delivering electronic engineering files per our contract requirements. Conduct more thorough review of consultant design at interim review points. Ensure that WSDOT personnel accepting consultant designs are trained to review the electronic engineering files, or have resources available to review the files before final acceptance of the project.

Recommendation 3.2
Evaluate options to help consultants meet our electronic engineering deliverable requirements. Options to consider include LandXML, changing our standards, and developing custom WSDOT AutoCAD standards.

Recommendation 3.3
Encourage local agencies to require WSDOT electronic deliverable standards when they are hiring consultants for design work on state highways and WSDOT is administering the construction contract.

Technology

Recommendation 4.1
WSDOT should seriously consider moving to an integrated software suite for roadway design and drafting to gain efficiencies.

An integrated suite would offer the following benefits.

- Eliminate data transfers and duplication of work with seamless data integration.
- Reduce the learning curve for CAD Operators moving into design positions because the look and feel of the software interface would be consistent.
- Increase efficiency for designers who use both applications.
- Reduce technical support and training needs.
- Eliminate software upgrade compatibility issues.

Recommendation 4.2
Encourage survey crew stability and maintain experienced party chiefs.

Recommendation 4.4
Ensure that training, change documentation, and procedural guidance are available before implementing new technology or releasing major engineering software upgrades.

Recommendation 4.6
Develop a more comprehensive WSDOT standard level structure using the unlimited level capability in MicroStation V8.

Recommendation 4.7
Electronically link common data in quantity & estimate applications to eliminate redundant entry of quantity data and reduce errors.

Recommendation 4.8
Set up some construction offices to pilot test technologies for contract administration.

Procedural Issues

Recommendation 5.1
Improve the usability and quality of asbuilt information. Existing hard copy asbuilt drawings should be scanned and made available electronically. Management should consider developing policy for future asbuilt documentation to be produced in the project design CAD file for the benefit of future projects. Improving the quality of asbuilt information should be given a higher priority.

Recommendation 5.2
Give higher priority and allow adequate time in project schedules for project closure, data clean up, and record keeping activities at major milestones.

Recommendation 5.3
Evaluate the current process for managing R/W plan information and R/W CAD files looking for opportunities to modernize.

Recommendation 5.4
Update the Plan Prep Manual to fix inconsistencies, provide better examples, and ensure the CAD standards are up to date with electronic resources.

Training

Recommendation 6.1
Project managers need to ensure that people attending training can apply what they have learned immediately. Training should be scheduled appropriately to accommodate timely application on projects. Self-teaching training materials should be developed to supplement instructor training as a "just-in-time" training resource and refresh aid.

Recommendation 6.2
Mentoring should be strongly encouraged as a method for people to learn project delivery procedures and technical tools.

Recommendation 6.3
Develop and deliver more training on basic principles of design, drafting and surveying.

Recommendation 6.4
Develop training for CAiCE that is focused on; use in construction, earthwork processing, and data transfers to MicroStation.